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Potential for Growing Nut Pines in Ontario

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There are several species of pine in the world which can produce both quality lumber and large quantities of cone nutlets of high nutritional value. The nuts are important not only as a source of food for wildlife but also for human consumption and commercial uses. In the northern hemisphere edible pines occur in the south-temperate, temperate and boreal forest zones of North America, Europe and Asia. Some of these species such as the Pinyon pine (*Pinus edulis* Engelm.) which grows in southwestern United States, are not hardy in Canada. However, there are three edible nut pines in Asia (Fig. 1) which could be grown in Ontario, namely: Korean pine (*P. koraiensis* Sieb. et Zucc.), Siberian stone pine (*P. sibirica* Du Tour), and dwarf stone pine (*P. pumila* (Pall.) Rgl.). The climatic zones for the geographic ranges of the three pine species in Asia (Fig. 1) closely relate to the climatic zone map prepared by Rehder (1940) for North America. It indicates that the Korean pine could be successfully grown on many of the fresh to dry sites in Ontario as far north as North Bay, while the range of the Siberian pine could be extended as far north as Timmins on the moist and wet podsolic soils and as far north as Moosonee for the dwarf stone pine.

As the three exotic pine species are exceptionally suitable for multiple use management on a variety of sites within their natural range, it is important to evaluate the biological, economic and environmental potential on corresponding areas in this country. In Ontario this could be accomplished by establishing a transect-like series of mini-plantations throughout the southern and northern part of the Province. Korean pine could be planted at 40 to 80 km (25 to 50 mile) intervals from Cambridge to North Bay while Siberian pine and dwarf pine could be extended from North Bay to Cochrane. Complementary trials should also be run on a series of plots from North Bay to Thunder Bay. Such a distribution of mini-plantations would permit a thorough evaluation of tree performance with respect to survival, growth, site requirements, hardiness, susceptibility to diseases, phenology, cone production, nutlet yields, provenances, etc.

Korean Pine

This species is the largest of the three pines attaining heights of up to 40 m (120 ft) and diameters at breast height of up to 2 m (6.5 ft). The bark is dark grey and relatively smooth. The crown is widely conical and the stem is frequently forked. New shoots are densely pubescent and lammas growth often occurs about 2 weeks subsequent to completion of the spring growth. The grey-green 5-needle fascicles measure up to 20 cm (8 inches) in length and persist on the trees for 2 to 3 years. The cone bearing age, under natural conditions, begins at 60 or more years; however, in plantations, cone production can be expected in 20 years after planting.

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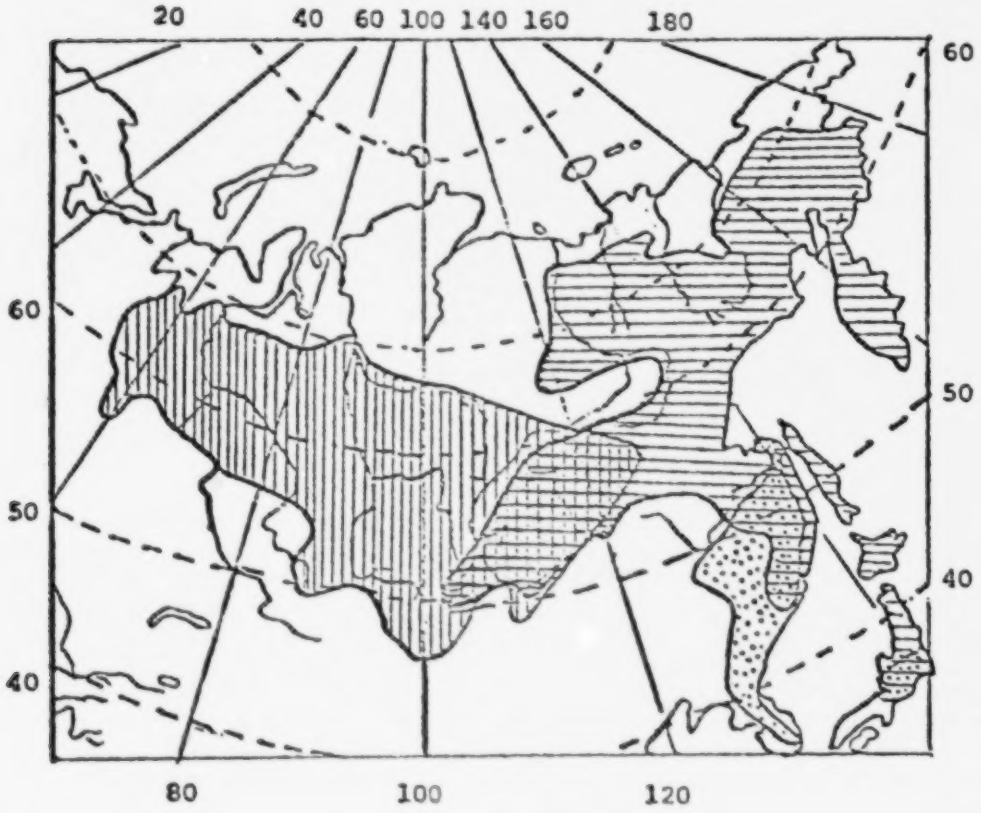

Figure 1 Geographic distribution of Korean pine , Siberian pine and dwarf stone pine in northern Asia and northeastern Europe. (From Korchagin 1972).

Flowering and pollination generally occur in mid-June when temperatures are 17°C or more with humidity remaining below 60%. The ovoid cones ripen in 2 years and range in length from 10 to 15 cm (4 to 7 inches), varying in number from 25 to 200 cones per tree depending on weather conditions, stand density, exposure, species composition, etc. One kilogram (2.2 lb.) of seed contains about 2000 nutlets and yields vary from 20 kg/ha (18 lb./acre) in mixed stands to 500 kg/ha (440 lb./acre) in mature, fully stocked forests. In Ontario, cones procured at Orono in 1976 from trees planted in 1947 of South Korean origin had a mean weight of 108 g (3.8 oz) and on the average contained 159 wingless seed weighing about 57 g (2 oz). The appearance of these trees, as well as their yield of cones, gave sufficient indication that the species has considerable potential for not only wood but also nut production in Ontario.

Korean pine grows in the far eastern mountainous regions of the USSR, China, Manchuria, Korea and Japan between latitudes of about 35° and 55° (Fig. 1). It occurs in mixtures with conifer and broadleaf species and reproduces naturally under a protective forest cover on dry rather than wet sites. On poorly drained lowlands it suffers from windfall and heart rot and is easily injured by ground fires. Although less hardy than the Siberian pine it is considered an exceptionally valuable species. The characteristically rose-coloured wood as well as the seed which has an even greater content of high-calorie oils (65%) than the Siberian pine are in high demand and find a wide application in a variety of industries, the nutlets being a particularly valuable food in Korea.

Siberian Stone Pine

This is one of the principal pines of the USSR. At maturity, the trees on better sites attain heights of 30 m (100 ft) or more. The greyish bark is deeply ridged and its resin is reputed to have medicinal properties. The cone-shaped crown is profusely covered with 5-needle fascicles which persist on the tree from 3 to 6 years. The dark green needles, from 6 to 12 cm (2 to 5 inches) long, have a high content of vitamin C as well as turpentine (5%) and resin (16%).

In widely spaced, natural stands flowering begins at 25 to 30 years, becoming more abundant with increased age and dominance. Under intensive management, flowering and increased cone production could be expected at an earlier age. The flowers appear in June, producing mature cones in 2 years. The cones, generally confined to the upper portions of the crown, range in length from 6 to 13 cm (2 to 5 inches); they remain closed while on the tree and are shed in the fall of the year following flowering. Production of cones is greatly influenced by climatic and edaphic factors, tree age and size, crown development, etc. The seed is wingless and not as large as that of Korean pine, measuring up to 15 mm (0.6 inches) in length and 9 mm (0.4 inches) in diameter. On the average, 1 kg (2.2 lb.) of seed contains 5000 nutlets as contrasted with 2000 nutlets for Korean pine. Sound seed retains a relatively high viability and can be stored for about 2 years. Under favourable conditions, individual cones contain as many as 150 nutlets ranging in soundness up to 80%. During good seed years, which generally occur in 3- to 5-year intervals, the yields in natural stands run as high as 400 kg/ha (325 lb./acre) with some trees producing from 1000 to 2000 cones at maturity. In virgin forests the seed is extracted, consumed and distributed by birds, squirrels and bears.

In the nursery, prolonged stratification is required prior to spring sowing; unstratified seed, sown in the fall, must be protected against rodents. Initially, young trees develop slowly, but at about 8 years of age their growth accelerates, particularly subsequent to thinning, and continues at a rapid rate until maturity.

Siberian pine ranges from the southern part of the Russian Socialist Federated Soviet Republic across Siberia to the east of Lake Baikal. Within its range, the pine extends over a total of about 29 million hectares (72 million acres) as principal species and an additional 7.5 million hectares (19 million acres) as a major associate of fir, spruce, larch, birch and poplar. In the south, the species is bounded by the open, arid steppe while in the north it grows even on permafrost soils reaching latitudes of 70°. In mountain regions the pine is capable of occupying sites bordering on the tree line: for instance, in Northern Urals the tree form persists up to 500 m (1650 ft) and in the Altai Mountains up to 2000 m (6500 ft) above sea level. At higher elevations, it occurs as a dwarfed or trailing variant of the same species. Siberian pine is very tolerant to shade and capable of surviving temperature extremes as low as -60°C. Within its range, the vegetative period varies from 120 to 180 days and yearly precipitation from 300 to 800 mm (12 to 32 inches). This species occurs on a wide variety of podsolic soils, thriving on moist and even seasonally flooded loams, but is also capable of growing on dry sandy and stony sites of relatively low fertility. The exceptionally wide site tolerance of Siberian pine is attributed partly to a special adaptability of its root system which, depending on conditions, may vary from a strongly developed but shallow root formation, occasionally buttressed by adventitious roots, to the characteristically deep tap-root system predominating on drier soils.

The wood of Siberian pine is highly prized for its excellent physical and mechanical properties being light, soft and easily turned. It is used in construction, pencil and furniture industry and because of its exceptional resonance, in the manufacture of musical instruments. The meat of the nutlets is in high demand by the food industry. Nutritional studies indicate that on the average the endosperm contains about 60% oil, 17% protein, 12% starch, 2% pentosans, 2% minerals and appreciable amounts of vitamin B. Oil and resin extracts are also widely used in the manufacture of fine lacquers, pharmaceutical products and perfumes.

Increasing interest in Siberian pine generated by its water conservation, food processing and wildlife supporting potential have resulted in intensive studies on such aspects as: selection, establishment of seed orchards, and hybridization and management of the species in natural stands and plantations.

Dwarf Stone Pine

This species is a hardy, shrub-like conifer ranging in height up to about 5 m (16.2 ft). The branches are widely spread and those at the base of the main stem persist and trail along the ground. New shoots are densely pubescent terminating in resinous buds. The characteristically rigid needles measuring from 2 to 8 cm (1 to 3 inches) in length, occur in fascicles of 5, remaining on the tree from 2 to 3 years.

In natural stands cone production begins when the tree is about 30 years of age. The average cone is about 5 cm (2 inches) long and contains about 38 relatively small nutlets. There are generally 10 000 nutlets in 1 kg of seed (4550 seeds per lb.) and the yields range from 50 to 200 kg/ha (44 to 176 lb./acre). The seed is edible and highly nutritious containing 42 - 48% oil as well as protein, starch and vitamins. Heavy seed years occur every 2 to 3 years.

This species has an exceptionally wide site tolerance ranging from northern permafrost tundra in Eastern Siberia to Lake Baikal, Sachalin Island, Korea and Northern Japan, spanning areas between 40° and 70° latitude. The southern portion of its range overlaps those of Korean and Siberian pines. The hardy tree may be found on sand dunes, steep stony slopes as well as in swamps. It performs an important ecological function by controlling erosion and providing shelter and food for wildlife.

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